

## **SLIM USB MALE CONNECTOR WITH SYSTEM GROUNDING**

### **BACKGROUND OF THE INVENTION**

#### **1. Field of the Invention**

The present invention relates to a slim USB male connector with system  
5 grounding, and particularly to a slim USB male connector complying with  
A-type USB specifications with a hidden grounding portion for achieving  
system grounding

#### **2. Description of the Prior Art**

The Universal Serial Bus (USB) is an astonishingly useful way to connect  
10 large numbers of peripherals together. It is becoming increasingly important in  
today's electronics world. One of the reasons that USB was implemented was  
to replace existing serial and parallel ports on computers. USB has several  
advantages for this application.

First, it uses a much higher data transfer rate than many common serial  
15 data formats.

Second, it allows a large number of devices to be attached to a single host  
USB connector. Up to 127 devices can theoretically be used on a single USB  
port.

Third, it simplifies the connection to external devices. USB supports "plug  
20 and play" where the operator does not need to be heavily involved in the set-up  
process. When a device is connected to a host's USB bus, it is immediately  
recognized by the host, dynamically enumerated, and assigned an address by  
the host.

Reference is made to FIG. 1, which is a perspective view of A-type USB  
25 socket (a female connector) and an USB connector (a male connector). The

A-type USB socket 70 and USB connector 90 follow A-type physical specifications for achieving electrical connection. The USB socket 70 is usually mounted on a PCB 80 of the host (not shown) grounded with the computer system. The USB socket 70 has a frame 72 and a mating board 76 mounted in

5 the frame 72. The frame 72 is formed by stamping a metal board and formed with a plurality of elastic tongues 74 on a periphery of the frame 72. The mating board 76 is formed with an insulative material and mounted with four contacts 78. A receiving space 79 is formed between the mating board 76 and the frame 72. The USB connector 90 uses a four-wire cable interface 91. Two

10 of the wires are used in a differential mode for both transmitting and receiving data, and the remaining two wires are power and ground. The source of the power to a USB device can come from the host or a hub. The USB connector 90 has a housing 92 made by stamping and formed with four cutouts 94 thereon, and a mating board 96 that is mounted in the housing 92 and disposed with four

15 terminals 98 on an upper surface thereof. The housing 92 complies with USB-IF grounding requirements by grounding with the computers via the USB socket 70. When the USB connector 90 is inserted into the USB socket 70, the tongues 74 of the frame 72 of the USB socket 70 are clipped and wedged in the cutouts 94 of the housing 92. The four terminals 98 of the mating board 96 are

20 respectively electrically connected with the contacts 78 of the mating board 76.

However, the metal housing 92 limits the size of the USB connector 90. When inserting the USB connector 90 into a stacked USB socket, it is crowded by the neighboring USB connector and is inconvenient. The slim design of the USB connector 90 is restricted by the housing 92 and the housing 92 becomes

25 an obstacle to slim design.

Hence, an improved slim USB male connector is required to overcome the disadvantages of the prior art.

#### SUMMARY OF THE INVENTION

The main object of the present invention is to provide a slim USB male  
5 connector with system grounding, and particularly to a USB male connector  
having a compact contour without the metal housing and complying with  
A-type USB specifications with a hidden grounding portion for achieving  
system grounding

In order to achieve the above objects, the present invention provides a slim  
10 USB male connector with system grounding that is mated with a USB socket.  
The USB socket has a frame stamped with a plurality of tongues, a mating  
board mounted in the frame, and four terminals mounted on a bottom of the  
mating board. The USB male connector is received in a space between the  
mating board and a bottom wall of the frame. The USB male connector  
15 comprises a circuit board formed with a plurality of circuits on top and bottom  
surfaces thereof. Four contacts are formed on the top surface of the circuit  
board and connected with the circuits thereon. A grounding plate is mounted on  
the bottom surface of the circuit board and connected with a grounding circuit  
on the circuit board. The grounding plate is connected to the tongues of the  
20 USB socket for achieving system grounding.

Other objects, advantages and novel features of the present invention will  
become more apparent from the following detailed description of the present  
embodiment when taken in conjunction with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and many of the attendant advantages of this invention will be more readily appreciated as the same becomes better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of A-type USB socket and an USB connector;

FIG. 2 is an exploded cross-sectional view of a slim USB male connector with system grounding according to the present invention;

FIG. 3 is a perspective view of the slim USB male connector applied in a storage device from different views;

FIG. 3A is a perspective view of the slim USB male connector applied in a storage device from a different view;

FIG. 4 is a top view of a flash memory card with the present invention plugged in a USB socket;

FIG. 5 is a cross-sectional view along line 5-5 in FIG. 4;

FIG. 6 is a side view of the slim USB male connector applied in a computer peripheral device; and

FIG. 7 is a perspective view of a connecting cable combined with the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference is made to FIG. 2, which is an exploded cross-sectional view of a slim USB male connector with system grounding according to the present

invention. The slim USB male connector 2 is mated with the USB socket 70 of the prior art. The USB socket 70 as mentioned above, has a frame 72 stamped with a plurality of elastic tongues 74, a mating board 76 mounted in the frame 72, and four terminals 76 mounted on a bottom of the mating board 76. A space 79 is formed between the mating board 76 and a bottom wall of the frame 72.

The USB male connector 2 is received in the space 79 of the USB socket 70. The USB male connector 2 comprises a circuit board 10, four contacts 12, and a grounding board 14.

10 The circuit board 10 is formed with a plurality of circuits (not shown) on a top surface 11 and a bottom surface 13 thereof.

The four contacts 12 are made of conductive metal, and mounted on the top surface 11 of the circuit board 10 and connected with the corresponding circuits thereon. The size of the four contacts 12 complies with the four contacts 78 of the USB socket 70, both physically and electrically. The four contacts 12 are contiguously in contact with the contacts 78 of the USB socket 70.

20 The grounding plate 14 is formed by stamping a metal board. The grounding plate 14 has two ends respectively soldered on the bottom 13 of the circuit board 10 and connected with a grounding circuit thereon. The grounding plate 14 is connected to the tongues 74 of the USB socket 70 for achieving system grounding.

An insulative housing 20 covers a periphery of the circuit board 10. The insulative housing 20 has an upper housing 22 and a lower housing 24 respectively formed with grooves 222, 242 for exposing the contacts 12 and the grounding plate 14 outside. The upper housing 22 has four upper grooves 222,

and protruding walls 224, 226 respectively protruding from two side edges thereof and between the upper grooves 22. The protruding walls 226 are respectively inserted into side gaps between the mating board 76 and two sides of the frame 72 of the USB socket 70.

5       The lower housing 24 of the insulative housing 20 has a pair of grounding grooves 242 for exposing the grounding plate 14 outside and receiving the tongues 74 of the frame 72 of the USB socket 70 therein. The grounding plate 14 is electrically connected to the tongues 74 with a fixing function.

Reference is made to FIG. 3 and FIG. 3A, which are perspective views of  
10 the slim USB male connector applied in a storage device from different views.  
The slim USB male connector 2 can be applied in different electrical devices  
with advantages of compact and convenient carrying. The slim USB male  
connector with system grounding 2 further comprises a storage device 3  
extending from an end of the circuit board 10 and forming a flash memory card  
15 1. The flash memory card 1 is more compact and slimmer due to the slim USB  
male connector 2. A plugging portion of the flash memory card 1 is as thin as  
the storage device 3, which is beneficial when applied in an electrical device  
such as, for example, a PDA, digital camera or notebook. A circuit layout of  
the storage device 3 is not the character of the present invention, and so is not  
20 mentioned here.

Referring to FIG. 4 and FIG. 5, FIG. 4 is a top view of a flash memory card with the present invention plugged in an USB socket, and FIG. 5 is a cross-sectional view along line 5-5 in the FIG. 4. A particularly distinguishing feature of the slim male connector 2 of the present invention is that the slim male connector 2 abandons the frame of prior art and replaces the same with an insulative housing 20 of non-metal material. The contacts 12 and the grounding

plate 14 are hidden in the insulative housing 20. The slim male connector 2 is only inserted in the lower space 79 of the USB socket 70. The slim male connector 2 entirely complies with the specifications and functions of USB and has a hidden grounding design for system grounding. The total height of the  
5 slim male connector 2 of the present invention is about half of the USB connector of the prior art, and the width thereof is reduced as well. The advantages of compact of the present invention are especially manifest when applied in the flash memory.

Reference is made to FIG. 6, which is a side view of the slim USB male  
10 connector applied in computer peripheral device. The slim male connector 2 of the present invention further comprises a cable 3' connecting with an end of the circuit board 10 and electrically connecting with the circuits of the circuit board 10. The cable 3' can be connected with a computer peripheral 4 such as, for example, a mouse or keyboard. Conversely, the cable 3' can be connected with  
15 an electrical connector 4' and form a connecting cable (as shown in FIG. 7) for transferring data between electric devices.

It is to be understood, however, that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention,  
20 the disclosure is illustrate only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.